1.0 Title and Approval Page

Document Title:	Rust Pond Diagnostic Study QAPP
Lead Organization:	New Hampshire Department of Environmental Services, Biology Section
Preparer's Name:	Amy P. Smagula
Organizational Affiliation:	NH Department of Environmental Services
Address:	6 Hazen Drive, PO Box 95 Concord, NH 03302-0095
Preparation Date (month/day/year):	April 16, 2001, Revised September 9, 2001

Project Manager: _____
Signature / Date

Amy P. Smagula, NH DES

Project QA Officer: _____
Signature / Date

Andrew Chapman, NH DES

Program Quality Assurance Coordinator: _____
Signature / Date

Andrea Donlon, NH DES

NHDES Quality Assurance Manager _____
Signature / Date

Vincent N. Perelli, NH DES

USEPA Project Manager: _____
Signature / Date

Warren Howard, US EPA Region I

USEPA QA Officer: _____
Signature / Date

Arthur Clark, US EPA Region I

Document control number:

TABLE OF CONTENTS
Rust Pond Lake and Watershed Diagnostic Study QAPP
Wolfeboro, New Hampshire

Table of Contents (continued)

Table of Contents (continued)

National Requirement and Guidance Document

List of Appendices

List of Tables

Table of Contents (continued)

List of Figures

3.0 Distribution List and Project Personnel Sign-Off Sheet

3.1 Distribution List

Table 3.1 illustrates the Distribution List

Table 3-1 Distribution List

QAPP Recipients	Title	Organization	Telephone Number
Amy P. Smagula	Clean Lakes and Exotic Species Coordinator	NHDES Biology Section	603-271-2248
Jody Connor	Limnology Center Director	NHDES Biology Section	603-271-3414
Andy Chapmap	QA/QC Officer, Biology Section	NHDES Biology Section	603-271-8801
Andrea Donlon	Program QA Coordinator	NHDES Watershed Management Bureau	603-271-8862
Vince Perelli	NHDES QA Manager	NHDES Commissioner's Office Planning Unit	603-271-8989
Warren Howard	US EPA Project Manager	US EPA-NE	617-918-1587
Art Clark	US EPA QA Officer	US EPA-NE	617-918-8374
Libby Pierd	President	Rust Pond Lake Association	603-569-2439
Rachel Rainey	Laboratory QA Officer	NHDES Laboratory Services	603-271-2993

3.2 Project Personnel Sign-off Sheet

The project personnel sign-off sheet is included in Table 3-2.

Table 3-2
Project Personnel Sign-Off Sheet

Organization: New Hampshire Department of Environmental Services

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read	QAPP Acceptable as Written
Amy P. Smagula	Clean Lakes and Exotic Species Coordinator	603-271-2248			
Jody Connor	Limnology Center Director	603-271-3414			
Andy Chapman	QA/QC Officer, Biology Section	603-271-8801			
Andrea Donlon	QAPP Officer	603-271-8862			
Rachel Rainey	QA/QC DES Lab Services	603-271-2993			
Libby Pierd	President	603-569-2439			
Vince Perelli	NHDES QA Mgr.	603-271-8989			

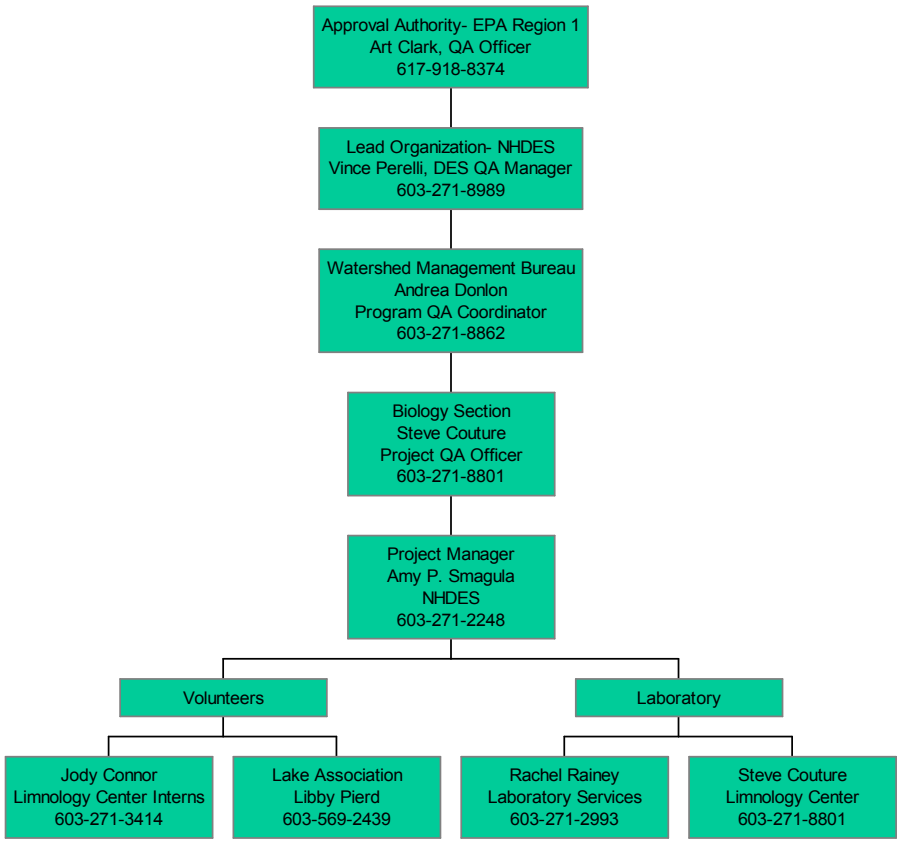
4.0 Project Organization

The Rust Pond Diagnostic Study requires the participation of a number of partners. The two major partners are NHDES Biology Section and the Rust Pond Association. Amy Smagula, NHDES Clean Lakes and Exotic Species Coordinator has the overall responsibility for training the volunteers from the Rust Pond Association in sample collection and watershed monitoring. A Citizen's Advisory Committee (CAC) will be developed to facilitate the process. The CAC will be represented by Amy Smagula (NHDES), Jody Connor (NHDES), Libby Pierd (Rust Pond Association) and by other lake association members to be determined prior to the start of the study. NHDES and the Rust Pond Association will collect samples from Rust Pond and its watershed. NHDES will be responsible for data management, report preparation, and making lake and watershed rehabilitation recommendations. Amy Smagula is responsible for the QAPP development. Steven Couture is QA Coordinator for the project Limnology Lab. Andrea Donlon is the program QA Coordinator. Quality Assurance issues that arise will be discussed between Amy Smagula, Steve Couture, and Andrea Donlon, and communicated to the EPA through Andrea Donlon.

4.1 Organization Chart

An organization chart that includes all parties involved, as well as their telephone numbers is included in Figure 4-1.

Figure 4-1
Organization Chart for Rust Pond Lake and Watershed Diagnostic Study



4.2 Communication Pathways

As coordinator of the study, Amy Smagula will be the primary contact for all parties involved in the Rust Pond Diagnostic Study. If problems arise in the field, laboratory, or in any phase of the study, Amy Smagula will be contacted and will determine the best course of action based upon the circumstances and the outcome of consultations with Jody Connor (Limnology Center Director) and Steve Couture (Limnology Center QA Officer).

4.2.1 Modifications to Approved QAPP

If changes or modifications to the QAPP are required, Amy Smagula will be responsible for drafting and submitting changes to US EPA-NE after communicating these changes to Andrea Donlon.

4.3 Personnel Responsibilities and Qualifications

Table 4-1 details personnel responsibilities and qualifications.

Table 4-1
Personnel Responsibilities and Qualifications

Name	Organization	Responsibilities	Education and Experience *
Amy P. Smagula	NHDES Biology Section	Project Manager	See Appendix A
Jody Connor	NHDES Biology Section	Oversees project progress	See Appendix A
Steve Couture	NHDES Biology Section	QA/QC Limnology Center	See Appendix A
Andrea Donlon	NHDES Watershed Assistance Group	QAPP Coordinator	See Appendix A
Vince Perelli	NHDES	NH DES QA Manager / QAPP Reviewer	See Appendix A
Rachael Rainey	NHDES Laboratory Services	Sample analysis and lab QA	See Appendix A

*Resumes are not included. NHDES Supplemental Job Descriptions (SJD) and Position Responsibilities are submitted in lieu of resumes.

4.4 Special Training Requirements/Certification

Any special training requirements or certifications for the above listed parties are detailed in the SJD for each person, which are included in Appendix A. Table 4-2 summarizes volunteer training.

Table 4-2
Special Training Requirements

Project function	Description of Training	Training Provided by	Training Provided to	Location of Training Records
Water Sampling	Water sample collection procedures	NHDES Project Manager, Amy Smagula	NHDES Limnology Center Interns and Rust Pond Association Volunteers	NHDES Limnology Center
Stream Data Collection	Measuring stream flow	NHDES Project Manager, Amy Smagula	NHDES Limnology Center Interns and Rust Pond Association Volunteers	NHDES Limnology Center

5.0 Project Planning/Problem Definition

5.1 Scoping Meetings

During July of 1999, DES personnel, including Amy Smagula, met to discuss the possibility of conducting a diagnostic study of Rust Pond and its watershed. The stimulus for this meeting was the summer 1999 Volunteer Lake Assessment Program (VLAP) results from Rust Pond, and a recurring increase in algal communities in the pond.

Another scoping meeting took place during February 2001 between Amy Smagula, Steve Couture, Andrea Donlon, and Bob Minicucci, all of NH DES. The purpose of this meeting was to review the components of the QAPP compendium and to set deadlines for the preparation of this QAPP.

Data collection activities for this project are for exploration purposes to make management recommendations, therefore the formal DQO process was not followed. Extensive statistical analyses are beyond the scope of this project.

5.2 Problem Definition

Justification for this study stems from the recurring seasonal algal blooms and increases in turbidity in Rust Pond. Sediment accumulations near the mouths of the tributaries suggest watershed activities may be contributing both to the increase in nutrients entering the lake, as well as an increase in the rate of lake sedimentation.

Data collected from the VLAP for the last two years have not shown an alarming drop in water quality, but subtle changes are evident. Total phosphorus samples collected in May 2000 exceeded the state median in the epilimnion of the lake, and were higher than any occurring later in the summer. Spring runoff likely contributed to this higher reading, and by conducting the diagnostic study of the lake and watershed, it will be possible to determine the sources of the phosphorus, and perhaps make recommendations for how to best reduce the nutrients in the watershed, thereby reducing the flux of nutrients with the spring flush. Further, total phosphorus concentrations in the lake in summer 2000 were slightly higher than they have been in the past two years.

Changes in overall algal dominance and relative abundance also indicate that changes in the lake are occurring. For the past few years various species of blue-green algae have been appearing as the top three species in the lake, mixed with other more typical NH lake species. Also, a bloom trend is occurring, with diatoms dominating the spring, golden browns becoming very abundant in the mid-summer, and blue-green algae often forming visible colonies in late summer. Blooms in these species of algae have been associated with unpleasant water odors as reported by lake residents.

Conductivity values in the north inlet have been consistently high for the past several years. In 2000, the mean conductivity value for this inlet was 232.5 μmhos/cm, compared to a

mean of 152.8 μmhos/cm in 1999. Conductivity values can be indicative of changing land use patterns and pollution sources in a watershed.

Overall, the lake is likely still considered in fair 'health.' The warning signs of water quality decline appear to be increasing in both occurrence and magnitude. A diagnostic study is an excellent means of determining sources of pollution in the watershed, and recommendations made from this study will prevent the further degradation of the lake and watershed.

A 16-month diagnostic study will be conducted on Rust Pond and its surrounding watershed to determine sources of phosphorus to the lake from the watershed. The study will begin on June 1, 2001, and will end on October 31, 2002. All water sources entering the lake will be measured for both quantitative water inputs and phosphorus concentrations.

The purpose of the diagnostic study is to assess the chemical and biological characteristics of the lake to determine overall health of the system.

Environmental results will be measured by making comparisons to established means and ranges of water quality for the state of New Hampshire. Chemical, biological, and physical parameters will be measured and compared to lakes in the area, and similar lakes throughout the state.

Site maps for the pond can be found in Appendix E.

6.0 Project Description and Schedule

6.1 Project Overview

The purpose of the Rust Pond Lake and Watershed Diagnostic Study is to determine the hydrologic and phosphorus budget of the lake, thereby identifying high and low sources of phosphorus to the lake. As the limiting nutrient in freshwater systems in this area, sources of phosphorus are important to know and understand so as to be minimized through recommended remediation and rehabilitation measures.

Ultimately, this study will present 12 of the 16 consecutive months of chemical, physical and biological data collected from Rust Pond and its watershed. Trend analyses and data interpretation will lead to a series of recommendations for projects that can be conducted on the local and state level to reverse trends in eutrophication and conserve the ecological and recreational benefits of the pond. A final report will be prepared to summarize the results of the study.

Table 6-1 summarizes the analytes to be sampled during the Rust Pond Lake and Watershed Diagnostic Study. Table 6-2 summarizes field and quality control sampling.

Table 6-1
Contaminants of Concern and Other Target Analytes Table

Analyte	Project Action Limit* (Units) (wet or dry weight)	Project Quantitation Limit (Units) (wet or dry weight)	Achievable Laboratory Limits	
			MDLs	QLs
Total Phosphorus[1]	N/A	0.005 mg/L	0.0008 mg/L	0.005 mg/L
Total Suspended Solids[1]	N/A	1 mg/L	N/A	1 mg/L
Conductivity[2]	N/A	2.00 µS/cm	0.39 µS/cm	2 µS/cm
Turbidity[1]	N/A	0.10 NTU	0.05 NTU	0.10 NTU
pH[1]	N/A	N/A	N/A	N/A
Alkalinity[1]	N/A	N/A	N/A	N/A
Chlorophyll-a[1]	N/A	0.50 mg/m^3	0.32 mg/m^3	0.50 mg/m^3
Plankton[1]	N/A	N/A	N/A	N/A
Dissolved Oxygen[3]	N/A	0.5 mg/L & 5% Air Saturation	N/A	0.5 mg/L & 5% Air Saturation

*Project Action Limits are not applicable in this study. This study is not the result of a regulatory issue, and the goal of the study is to test for current condition, not action limits.
[1]-NHDES Laboratory Services
[2]-NHDES Limnology Center
[3]-YSI 52 Field DO Meter

Sampling Tasks:

- Establish a staff gage—each consisting of two inlets and one outlet—and flow site on each tributary flowing into and out of the pond. These locations will be selected based on accessibility and stream bottom composition. Flat-bottomed portions of the stream with unobstructed flow will be selected for staff gage installation. All stream samples will be collected from these established sites, as well as in-lake samples collected from the deep spot of the lake. Sample flows and staff gauge readings will be taken bi-weekly for 12 months. Sample locations are indicated on maps in Appendix E, and a table details sampling locations. Seepage and IPWS locations are also indicated on the map. Six meters will be installed and IPWS will be done at the same location.
- Water chemistry samples will also be collected bi-weekly (independent of weather conditions), and will include the following parameters: turbidity, conductivity, pH, and total phosphorus in each tributary. In-lake samples will be collected from June through August, and will include each of the previously listed parameters, as well as an analysis of chlorophyll-a, Secchi Disk depth, temperature/oxygen, alkalinity, seepage, and interstitial pore water samples.

- Turbidity will be sampled to determine the level of suspended material in the sample
- Conductivity will be sampled to determine the amount of ions in the sample
- pH will be sampled to determine the acidity/alkalinity of the water
- TSS will be sampled during a storm event to determine the amount of sediment loading to the lake
- Total phosphorus will be sampled to determine the concentration of this limiting nutrient at each sampling location, and to use in the nutrient budget
- Chlorophyll-a will be measured to obtain an estimate of algal biomass
- Secchi disk depth will be measured as an indication of water clarity
- Oxygen concentrations will be measured to determine overall concentration and changes in those concentrations in the water column
- Temperature will be measured along the water column to determine layering due to thermal stratification
- Groundwater seepage will be measured to obtain an estimate of the amount of groundwater flowing into the lake
- Interstitial pore water samples will be analyzed for pH, turbidity, conductivity, and total phosphorus to determine the overall quality of the groundwater entering the lake
- Acid neutralizing capacity will be measured to determine the buffering capacity of the lake
- At one time during the course of the Rust Pond Study, a rain event sampling will be conducted. A storm event will be selected that is high in intensity and short in duration (summer thunderstorms are usually the best). This sampling is intensive in that it involves one or more volunteers to remain at a predetermined stream from the beginning of the storm until peak stream flow has been reached. Phosphorus, TP, conductivity, turbidity, and total suspended solids samples, as well as staff gage readings, will be collected every half hour from the start point of the storm.

System Designs: This project does not require remediation and/or monitoring engineered designs.

Analysis Tasks: The DES Limnology Center will analyze turbidity, conductivity, pH, alkalinity and chlorophyll-a, and the DES Laboratory Services Unit will analyze TSS and total phosphorus, as detailed in the SOPs included in Appendix C. Table 6-3 summarizes information relevant to analytical services.

Quality Control Tasks: Quality control tasks for each parameter will be as detailed in Appendices B and C.

Secondary Data: Precipitation data obtained from Lakeport is secondary data.

Data Management Tasks: Field data will be recorded on a field sheet and entered into a computer database upon return to the office. Laboratory data will be entered into a bench book and then entered into a spreadsheet program (such as MS Excel, Lotus, Sigma Plot, and FoxPro)

for analysis and tracking. Data printouts will be cross-referenced with bench book results for verification/validation purposes.

Documentation and Records: Field sampling sheets with checklists will be used throughout the study to ensure an all inclusive sample event. Hardcopy and computer records will be kept for each parameter.

Data Packages: N/A

Assessment/Audit Tasks: Assessments and audits are components of the NHDES Quality Assurance/Quality Control Plan. Replicates are run for every ten samples in the chemistry and limnology laboratories, and the data are presented in a QA/QC report at the end of each year. These replicates are analyzed to determine if they fall within the critical range for that parameter.

Data Verification and Validation Tasks: Data verification will include examining QA data by means of replicate and critical range checks, internal consistency checks of spiked samples and duplicate samples. Questionable data will be highlighted and examined to determine the origin of the deviation. The validation involves assessing the reasonableness of the data based on the measured and the expected values for that parameter. Data will be compared with existing and historical data from individual sampling locations. These tasks are described in more detail in Sections 18 and 19.

Data Usability Assessment Tasks: Data usability will be based on data verification and validation. Section 20 discusses more data usability assessment tasks.

Table 6-2
Field and Quality Control Sample Summary Table

Medium/ Matrix	Analytical Parameter	Analytical Method/SOP Reference	No. of Sampling Locations	No. of Field Duplicate Pairs	No. of Bottle Blanks	Total No. of Samples to Lab
Surface Water (SW)	Total Phosphorus	EPA 365.2/ C-9	12	1	1	14
SW	Total Suspended Solids	EPA 160.2/ C-10	6	1	1	8
SW	Conductivity	2510B Standard Methods 20th Ed. 1998/ C-3	12	1	1	14
SW	Turbidity	2130B Standard Methods 20th Ed. 1998 C-4	12	1	1	14
SW	pH	2310B Standard Methods 20th Ed. 1998 C-1	12	1	1	14
SW	Alkalinity	2320B Standard Methods 20th Ed. 1998/ C-2	1	1	1	3
SW	Chlorophyll-a	10200H Standard Methods 20th Ed. 1998 C-5	1	1	1	3
SW	Plankton	10200 E-F	1	1	1	3

Medium/ Matrix	Analytical Parameter	Analytical Method/SOP Reference	No. of Sampling Locations	No. of Field Duplicate Pairs	No. of Bottle Blanks	Total No. of Samples to Lab
		Standard Methods 20th Ed. 1998/ C-12				
SW	Dissolved Oxygen	YSI Model	1	1	1	3

Table 6-3
Analytical Services Table

Medium & Matrix	Analytical Parameter	Analytical Method/SOP[1]	Data Package Turnaround Time	Lab/Organization
SW	Total Phosphorus	EPA 365.2/ C-9	30 d	NHDES Laboratory Services 6 Hazen Drive Concord, NH 03301 Rachel Rainey
SW	Total Suspended Solids	EPA 160.2/ C-10	14 d	“”
SW	Conductivity	2510B Standard Methods 20th Ed. 1998/ C-3	24 hours	NHDES Limnology Center 6 Hazen Drive Concord, NH 03301 Steve Couture
SW	Turbidity	2130B Standard Methods 20th Ed. 1998 C-4	24 hours	‘’
SW	pH	2310B Standard Methods 20th Ed. 1998 C-1	24 hours	“”
SW	Alkalinity	2320B Standard Methods 20th Ed. 1998/ C-2	24 hours	“”
SW	Chlorophyll-a	10200H Standard Methods 20th Ed. 1998 C-5	7 days	“” “”
SW	Plankton	10200 E-F Standard Methods 20th Ed. 1998/ C-12	30 days	“” “”

6.2 Project Schedule

Task	Responsible Party*	Time
QAPP Preparation	DES	March/April 2001
Develop Memorandum of Understanding	DES/RPA	May 2001
Develop Team of Volunteers	RPA	May 2001
Organizational Meeting/Training Session	DES/RPA	May 2001
Volunteer Watershed Walk	RPA	May 2001
DES Staff Watershed Walk	DES	May 2001
Purchase Necessary Materials (Gages, etc.)	RPA	May 2001
Install Staff Gages	DES/RPA	May 2001
Volunteer Sampling/Monitoring Training	DES	May 2001
Begin Tributary Sampling	RPA	June 2001
Begin Bi-Weekly Staff Gage Reading and Stream Flow Monitoring	DES	June 2001
Field Sampling TSA	DES/RPA	June 2001
Fixed Laboratory TSA	DES	June 2001
Install Seepage Meters	DES/RPA	May 2001
Begin Interstitial Pore Water Sampling (IPWS)	DES/RPA	May 2001
Begin Summer Sampling (boat)	RPA	May 2001
Aquatic Weed Survey (boat)	DES/RPA	July 2001
Storm Event Sampling	RPA	Anytime
Septic System Survey Form Distribution	RPA/DES	Fall 2001
Update Meeting	DES/RPA	Fall 2001
Begin 2nd Summer Sampling (In-Lake)	DES/RPA	May 2002
End Of Study Sampling	RPA	August 2002
Begin Report Preparation	DES	September 2002

*DES-Department of Environmental Services RPA-Rust Pond Association

If project delays occur, Amy Smagula will make necessary notifications and arrangements.

7.0 Project Quality Objectives and Measurement Performance Criteria

7.1 Project Quality Objectives

Who will use the data?
NHDES- reporting, recommendations
VLAP- reference data, recommendations
Rust Pond Association- rehabilitation measures, BMPs, land use changes, reference
Town of Wolfeboro- zoning changes, reference, assessments
EPA Region 1- regional data comparisons

What will the data be used for?
NHDES will use the data to prepare a report on current lake and watershed conditions, and to make recommendations about rehabilitation measures in both the lake and watershed.

The VLAP Program will use the summer lake data for incorporation into their annual reports.

The Rust Pond Association will use the data as evidence in the event that BMP installation and lake rehabilitation measures are necessary.

The data will also be available to other interested parties, such as EPA, for regional reporting purposes.

What types of data are needed?
Quantitative and qualitative data for total phosphorus, conductivity, turbidity, total suspended solids, pH, chlorophyll-a, alkalinity, plankton, and clarity will be needed to determine overall water quality conditions. Project action limits for these parameters need not be established because this is not a regulatory issue. The goal of this study is to test for current conditions in the lake and watershed. Analytical parameters and field and laboratory techniques are detailed in the SOPs in Appendix B and C.

How 'good' do the data need to be?
Data need to be collected on a consistent basis, with 10% replication and 10% blanks analyzed with the samples. Data need to be representative of the conditions throughout the lake and watershed. Precision, accuracy/bias, and quantitation limits are included in the SOPs in Appendix C.

How much data are needed?
Twelve consecutive months of data collected from each station on a bi-weekly schedule over the span of 16 months will be adequate to determine seasonal and monthly trends in loading and water quality. This sampling regime will yield approximately 32 data points per station, per parameter, not including replicates (except in-lake which will only be sampled during the summer season).

When, where and how should data be generated/collected?
Data will be collected according to the field sampling protocols outlined in Appendix B.

Who will collect and generate the data?
DES Biologists, DES-trained seasonal interns, and trained volunteer lake monitors from Rust Pond Association will collect and generate the data.

How will the data be reported?
Data will be analyzed, and means and ranges will be calculated for each parameter. Data summary statistics will be used to determine means, ranges, medians and standard deviations to identify outliers and measurement errors. These data will be compared with historical water quality data and with New Hampshire means to determine changes and relative health of the lake and watershed.

The final report will include history of the area, data results, data interpretation, a hydrologic budget, a nutrient budget, and sampling observations for both in-lake and watershed samples. Modeling will be conducted using four different trophic state models to determine current trophic state. The final chapter of the report will point out problem areas in the watershed and make recommendations about remediation and rehabilitation measures.

7.2 Measurement Performance Criteria

Precision. Precision will be measured by analyzing sample replicates and determining if those replicates fall within the critical range for that testing protocol. If the replicate falls within the critical range, the precision will be acceptable. If the replicate falls outside of the critical range, the sample will be run again to determine if there was an analyst error or an equipment error that led to the imprecision.

Duplicate precision will be analyzed using the equation:

$$\text{Relative Percent Difference} = \frac{|x_1 - x_2|}{\frac{x_1 + x_2}{2}} \times 100\ \%$$

where x_1 is the original sample concentration
x_2 is the replicate sample concentration

RPDs < 5% will be deemed acceptable.

Accuracy/Bias
Accuracy/Bias will be determined through the completion of field blanks and standard checks for sample accuracy within method ranges. Accuracy for total phosphate is determined through the analysis of spiked samples.

Representativeness

Sample locations were chosen to be representative of conditions in the watershed. Tributary sample locations were chosen to maximize the extent of stream channel that water travels through before entering the lake, providing for the opportunity for potential contaminants to be detected as they enter the lake. Samples locations will also be chosen to coincide with those established by the NHDES VLAP Program.

The deep spot of the lake was chosen as a sampling site so as to be representative of all depth conditions present in the lake. The deep spot is found using a depth meter, triangulation off from shoreline points, and through sounding.

Seepage meter locations were randomly selected around the lake, and by the number and the distribution of these locations, a good representation of all conditions around the lake edge is achieved. Seepage meter locations can be found in Appendix E.

Comparability

Comparability between samples will be achieved through maintaining consistency with SOPs, sampling locations, and sampling methods. Samples will be collected in the same locations, at the same time of day, and will have the same holding times. As the sample locations will coincide with those of an existing NHDES program, data comparisons will be made between the data collected for this study, and those collected for the VLAP program.

Sensitivity

Background information on each proposed sampling location exists, and the data show that the methods and instruments are able to detect the analyte of concern and other target compounds at the level of interest. Detectable ranges of the methods and the equipment (as shown in methods and SOPs) are adequate for the purposes of this study design.

Completeness

The guidelines and protocols for the sampling procedures, when followed, will yield more than adequate sample quantities for analysis. Whole data set completeness should be 90%, and critical data should be at least 75% of the proposed sample yield. Because sampling is done in any weather condition, it is unlikely that many planned sampling episodes will be missed. However, it is always possible that an event will occur that will force sampling to be delayed.

8.0 Sampling Process Designs

8.1 Sampling Design Rationale

Site Selection for Stream Gauging/Monitoring:

Tributary monitoring sites will be selected close to the lake edge to account for all inputs to streams from the watershed. Stations will be established far enough upstream from lake edge so as to prevent lake effects or back-flushing into the stream.

Site Selection for In-Lake Monitoring:

The lake will be monitored at the deepest spot. This location will be determined through the use of a depth meter, and will be verified through sounding the bottom prior to each sampling event. This is the method that has been consistently used by NHDES.

Biota Sampling:

An 80-micron mesh net will be used to collect plankton from the bottom of the photic zone to the surface of the water. Samples will be collected from May through September to determine the spring and summer seasonal progression of both phytoplankton and zooplankton.

Precipitation/Evaporation Data

These data will be requested from a local weather monitoring station maintained by NH DES close to Rust Pond, . The Lakeport Dam on Lake Winnipesaukee in Lakeport is will be the source of these dates.

Sample compositing:

The only samples that will be composited are chlorophyll-a. A 1-liter sample from each meter of the photic zone of the lake will be collected, mixed in a bucket, and poured into an amber 1-liter bottle.

Table 8-1 summarizes sampling locations, sampling and analysis methods/SOP requirements. Sample location maps are included in Appendix E.

Table 8-1
Sampling Locations, Sampling and Analysis Method/SOP Requirements Table

Sampling Location	Medium/ Matrix	Depth (Units)	Analytical Parameter	No. of Samples (Identify field duplicates and replicates)	Sampling SOP	Analytical Method/SOP	Containers (Number, size and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
North End Inlet	Surface Water	Mid-depth	Total Phosphorus	2	B-2	C-8	1- 250 mL amber plastic	1 mL Sulfuric Acid, pH<2 light protected 4°C	28 Days
	Surface Water	Mid-depth	TSS	2	B-2	C-9	1- 250 mL plastic	light protected 4°C	7 days
	Surface Water	Mid-depth	Turbidity	2	B-2	C-4	1-1L plastic	light protected 4°C	24 Hours
	Surface Water	Mid-depth	Conductivity	2	B-2	C-3	1-1L plastic	light protected 4°C	24 Hours
	Surface Water	Mid-depth	pH	2	B-2	C-1	1-1L plastic	light protected 4°C	24 Hours
Perry Brook Inlet	Surface Water	Mid-depth	Total Phosphorus	2	B-2	C-8	1- 250 mL amber plastic	1 mL Sulfuric Acid, pH<2 light protected 4°C	28 Days
	Surface Water	Mid-depth	Turbidity	2	B-2	C-4	1-1L plastic	light protected 4°C	24 Hours
	Surface Water	Mid-depth	Conductivity	2	B-2	C-3	1-1L plastic	light protected 4°C	24 Hours

Sampling Location	Medium/ Matrix	Depth (Units)	Analytical Parameter	No. of Samples (Identify field duplicates and replicates)	Sampling SOP	Analytical Method/SOP	Containers (Number, size and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
	Surface Water	Mid-depth	pH	2	B-2	C-1	1-1L plastic	light protected 4°C	24 Hours
Outlet	Surface Water	Mid-depth	Total Phosphorus	2	B-2	C-8	1- 250 mL amber plastic	1 mL Sulfuric Acid, pH<2 light protected 4°C	28 Days
	Surface Water	Mid-depth	Turbidity	2	B-2	C-4	1-1L plastic	light protected 4°C	24 Hours
	Surface Water	Mid-depth	Conductivity	2	B-2	C-3	1-1L plastic	light protected 4°C	24 Hours
	Surface Water	6 inches	pH	2	B-2	C-1	1-1L plastic	light protected 4°C	24 Hours
Epilimnion	Surface Water	3 M	Total Phosphorus	2	B-1	C-8	1- 250 mL amber plastic	1 mL Sulfuric Acid, pH<2 light protected 4°C	28 Days
	Surface Water	3 M	Turbidity	2	B-1	C-4	1-1L plastic	light protected 4°C	24 Hours
	Surface Water	3 M	Conductivity	2	B-1	C-3	1-1L plastic	light protected 4°C	24 Hours
	Surface Water	3 M	pH	2	B-1	C-1	1-1L plastic	light protected 4°C	24 Hours
	Surface Water	3M	ANC	2	B-1	C-2	1-1L plastic	Light protected 4°C	24 Hours

Sampling Location	Medium/ Matrix	Depth (Units)	Analytical Parameter	No. of Samples (Identify field duplicates and replicates)	Sampling SOP	Analytical Method/SOP	Containers (Number, size and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
	Surface Water	3M	Chl-a	2	B-1	C-5	1 1L plastic, amber	light protected 4°C	24 Hours
	Surface Water	3M	DO	2	B-1	C-6	N/A	N/A	N/A
Metalimnion	Surface Water	6 M	Total Phosphorus	2	B-1	C-8	1- 250 mL amber plastic	1 mL Sulfuric Acid, pH<2 light protected 4°C	28 Days
	Surface Water	6 M	Turbidity	2	B-1	C-4	1-1L plastic	light protected 4°C	24 Hours
	Surface Water	6 M	Conductivity	2	B-1	C-3	1-1L plastic	light protected 4°C	24 Hours
	Surface Water	6 M	pH	2	B-1	C-1	1-1L plastic	light protected 4°C	24 Hours
Hypolimnion	Surface Water	9 M	Total Phosphorus	2	B-1	C-8	1- 250 mL amber plastic	1 mL Sulfuric Acid, pH<2 light protected 4°C	28 Days
	Surface Water	9 M	Turbidity	2	B-1	C-4	1-1L plastic	light protected 4°C	24 Hours
	Surface Water	9 M	Conductivity	2	B-1	C-3	1-1L plastic	light protected 4°C	24 Hours
	Surface Water	9 M	pH	2	B-1	C-1	1-1L plastic	light protected 4°C	24 Hours

Sampling Location	Medium/ Matrix	Depth (Units)	Analytical Parameter	No. of Samples (Identify field duplicates and replicates)	Sampling SOP	Analytical Method/SOP	Containers (Number, size and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Interstitial Pore Water Sampling	Groundwater	.25 M	Total Phosphorus	2	B-6	C-8	1- 250 mL amber plastic	1 mL Sulfuric Acid, pH<2 light protected 4°C	28 Days
	Groundwater		Turbidity	2	B-1	C-4	1-1L plastic	light protected 4°C	24 Hours
	Groundwater		Conductivity	2	B-1	C-3	1-1L plastic	light protected 4°C	24 Hours
	Groundwater		pH	2	B-1	C-1	1-1L plastic	light protected 4°C	24 Hours

9.0 Sampling Procedures and Requirements

9.1 Sampling Procedures

See Appendices B and C for SOPs associated with sampling procedures, field equipment calibration, field equipment maintenance, and laboratory sampling. Table 9-1 provides an SOP reference table.

Table 9-1
Project Sampling SOP Reference Table

Reference Number	Title	Originating Organization	Equipment Identification	Modified for the Project Work
B-1	Secchi Disk Clarity	NHDES	Secchi Disk	N
B-2	Standard In-lake Field Sample Collection Procedures	NHDES		
B-3	Standard Tributary Field Sampling Procedures	NHDES		
B-4	Standard Operating Procedures for Stream Flow Determinations	NHDES		
B-6	Plankton	NHDES	Plankton Net	N
B-6	IPWS	NHDES	IPWS Probe Peristaltic Pump	N
B-7	Seepage	NHDES	Seepage meters	N
B-8	Storm Event	NHDES	Bottles	N
C-1	pH	NHDES	Meter	N
C-2	ANC	NHDES	Meter/Titration	N
C-3	Conductivity	NHDES	Meter	N
C-4	Turbidity	NHDES	Meter	N
B-1/C-5	Chlorophyll-a	NHDES	Integrated Sampler	N
B-1/C-6	Temperature/Dissolved Oxygen	NHDES	Meter	N

9.2 Sampling SOP modifications

No modifications have been made.

9.3 Cleaning and Decontamination of Equipment/Sample Containers

Information on cleaning SOPs can be found in the equipment cleaning SOPs in Appendix C. Field equipment will be rinsed free of any attached aquatic life when in the field.

Table 9-2
Equipment Contact with Media/Matrix

Equipment	Surface Water	Interstitial Pore Water
Staff gauge	X	
Flow meter	X	
Temp/DO meter	X	
Kemmerer Bottle	X	
Secchi Disk	X	
Plankton Net	X	
Interstitial Pore Water Sampler		X

9.4 Field Equipment Calibration

SOPs in Appendices B and C detail calibration methods. Table 9-3 summarizes the field sampling equipment calibrations.

Table 9-3
Field Sampling Equipment Calibration Table

Equipment	Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Flow meter	Fill bucket and insert probe, take reading	Each use	0 reading	Check battery Recalibrate Send meter back if it won't calibrate	Amy Smagula	B-4
Temp/DO meter	Per manual	Each use	Calibration to 100% saturation	Check battery Wet sponge Check for bubbles	Field personnel Amy Smagula	B-1

Table 9-4
Field Equipment Maintenance, Testing and Inspection

Sampling Equipment	Maintenance Activity	Testing/Inspect. Activity	Responsible Person	Frequency	Acceptable Criteria	Corrective Action	SOP
Temp/DO Meter	Change Battery/Change Membrane	Battery Check Calibration	Amy Smagula	Prior to each use	Calibration and no bubbles	Send back to company	B-1

9.5 Field Equipment Maintenance, Testing, and Inspection

Section 11 covers field analytical methods.

9.6 Inspection and Acceptance Requirements for Supplies/Sample Containers

Supplies and sample containers will be examined by the project manager prior to use. Extra sample supplies and containers will be brought in the field in the event that contamination or damage of another container occurs. SOP C-11 summarizes equipment procedures.

10.0 Sample Handling, Tracking, and Custody Requirements

10.1 Sample Collection Documentation

10.1.1 Field Notes

Field notes will be taken on NHDES issued field-sampling sheets. These sheets will include the following information:

- Site name and location
- Field sampler name and information
- Sample date/time
- Weather conditions
- Site observations
- Station location
- Secchi disk depth (in-lake only)
- Temp/DO Profiles
- Flow readings (for stream sites)
- Seepage readings (in-lake only)

Examples of field data sheets are included in Appendix D.

10.1.2 Field Documentation Management System

Field sheets will be used as described above. Volunteers or NHDES staff will complete each task-specific sheet in the field and turn them in to the Project Manager when samples are delivered to the laboratory. The Project Manager will be responsible for tracking these field sheets, and entering the data into a database.

10.2 Sample Handling and Tracking System

A single field sample collection form will be used to identify and track samples collected in the field. This form also has a section for delivery to the fixed laboratory.

In the field: Sample bottles are labeled in the field with waterbody name/town, sample location, sample date, sample time, and the collector's initials. No numbers are assigned to the field samples unless replicates are being collected, in which case a #1, #2, etc. system is used to indicate the samples and the order in which they were taken. Water samples will be placed on ice in a cooler immediately after collection and transported to NHDES for analysis by the sample collector.

In the Limnology Laboratory: Samples are logged into a computer database system which prints out a label for each logged sample. The label contains information such as waterbody name/town, sample location, sample date, sample time, collectors' initials, log-in date and time, and the parameters to be run on the sample. An example of the label is shown in Appendix D.

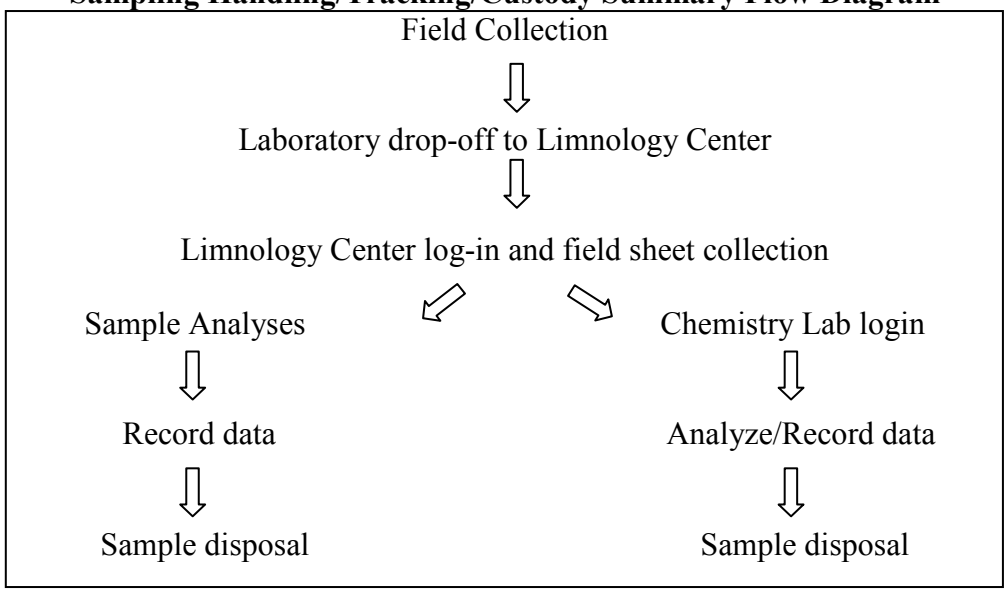
This login system also assigns a number to the sample which is tracked through both the Limnology Center Laboratory and the Laboratory Services Unit. These numbers are assigned in consecutive order in a database as samples are logged in, starting with the year, followed by the sample number in the system (e.g., 2001-XXXX).

All samples are kept at 4^{o}C in the field and between laboratories. In the Limnology Center, samples are warmed to 25^{o}C for analyses. See Table 8-1 or Appendix B and C for sample container, volume, and preservation information and holding time information.

When samples are transferred to the Laboratory Services Unit they are listed on a transfer sheet by station location, sample number, matrix, and analytical parameter. An area for signing off for custody is included on the lab sheet.

Figure 10-1 summarizes the sampling handling, tracking, and custody channel that all samples go through. The Limnology Center personnel, supervised by Steve Couture, the QA/QC officer for the laboratory, conduct sample archival activities. Sample disposal is down the sink unless (most are just surface water lake samples) otherwise specified in the SOPs in Appendix C.

Figure 10-1
Sampling Handling/Tracking/Custody Summary Flow Diagram



10.3 Sample Custody

See Figure 10-1 above for a flow chart showing sample custody. Chain of custody is monitored through the use of field data sheets and laboratory log-in sheets described above and exemplified in Appendix D.

11.0 Field Analytical Method Requirements

11.1 Field Analytical Methods and SOPs

See Appendix B for field method SOPs. See Table 11-1 for a Field Analytical Method/SOP Reference Table.

Table 11-1
Field Analytical Method/SOP Reference Table

Reference Number	Title	Originating Organization	Equipment Identification	Modified for the Project Work
B-4	Stream Flow	NHDES	Flow Meter	N
B-1/C-6	Temperature/Dissolved Oxygen	NHDES	Meter	N
B-1	Secchi Disk Clarity	NHDES	Secchi Disk	N

11.2 Field Analytical Method/SOP Modifications

No modifications will be made.

11.3 Field Analytical Instrument Calibration

See Appendix B for field analytical instrument calibration methods. Table 9-3. summarizes field analytical instrument calibration.

11.4 Field Analytical Instrument/Equipment Maintenance, Testing and Inspection Requirements

See SOPs for individual pieces of field equipment. Table 9-3 summarizes field analytical instrument calibration. Please reference Table 9-3.

11.5 Field Analytical Inspection and Acceptance Requirements for Supplies

All necessary supplies are already acquired and are in ample abundance for the requirements of this study. All equipment is maintained before and immediately following each use to assure availability upon need. The project manager will be responsible for inspection and maintenance of supplies. Supply SOP information is included in SOP C-11 in Appendix C.

12.0 Fixed Laboratory Analytical Method Requirements

12.1 Fixed Laboratory Analytical Methods and SOPs

See Appendix C for fixed laboratory SOPs. See Table 12-1 for a Fixed Laboratory Method/SOP reference table.

Table 12-1
Fixed Laboratory Method/SOP Reference Table

Appendix Reference Number	SOP Title	Originating Organization	Equipment Identification	Modified for the Project Work
B-1/C-5	Chlorophyll-a	NHDES	Integrated Sampler	N
B-6	Plankton	NHDES	Plankton Net	N
C-1	pH	NHDES	Meter	N
C-2	ANC	NHDES	Meter/Titration	N
C-3	Conductivity	NHDES	Meter	N
C-4	Turbidity	NHDES	Meter	N
C-9/B-1	Total Phosphorus	NHDES	Laboratory Equipment/Auto analyzer	N
C-10	Total Suspended Solids	NHDES	Laboratory Equipment/Meter	N

12.2 Fixed Laboratory Analytical Method/SOP Modifications

No modifications will be made.

12.3 Fixed Laboratory Instrument Calibration

See Appendix B for individual instrument calibration. See Table 12-2 for the fixed laboratory instrument maintenance and calibration table.

12.4 Fixed Laboratory Instrument/Equipment Maintenance, Testing, and Inspection Requirements

See Appendix B for individual instrument information. Table 12-2 summarizes fixed laboratory instrument/equipment maintenance, testing, and inspection requirements.

12.5 Fixed Laboratory Inspection and Acceptance Requirements for Supplies

All necessary supplies are already acquired and are in ample abundance for the

requirements of this study. All equipment is maintained before and immediately following each use to assure availability upon need. The project manager will be responsible for inspection and maintenance of supplies. Supply SOP information is included in SOP C-11 in Appendix C.

Table 12-2
Fixed Laboratory Instrument Maintenance and Calibration Table

Instrument	Activity	List Maintenance, Testing and Inspection Activities	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	Method/SOP Reference
TP	Per method described in method SOP	Per method described in method SOP	Each Day	Calibrate to known calibration standards	Check standards, recalibrate	Rachel Rainey	C-9
TSS	Per method described in method SOP	Per method described in method SOP	Each Day	Calibrate to known calibration standards	Check standards, recalibrate	Rachel Rainey	C-10
pH	Per method described in method SOP	Per method described in method SOP	Each Day	Calibrate to known calibration standards	Check standards, recalibrate	Limnology Center Personnel	C-1
Conductivity	Per method described in method SOP	Per method described in method SOP	Each Day	Calibrate to known calibration standards	Check standards, recalibrate	Limnology Center Personnel	C-3
Turbidity	Per method described in method SOP	Per method described in method SOP	Each Day	Calibrate to known calibration standards	Check standards, recalibrate	Limnology Center Personnel	C-4
Chlorophyll-a	Per method described in method SOP	Per method described in method SOP	Each Day	Calibrate to known calibration standards	Check standards, recalibrate	Limnology Center Personnel	C-5
Plankton	N/A	N/A	N/A	N/A	N/A	N/A	C-12

13.0 Quality Control Requirements

13.1 Sampling Quality Control

See Table 13-1.

Analytical parameters do not have multiple analytes, therefore a field sampling SOP precision and accuracy table is not needed here.

13.2 Analytical Quality Control

All required analytical QCs shall be conducted according to EPA-NE required frequencies.

13.2.1 Field Analytical Quality Controls

Tables 13-2 A & B summarize field analytical QCs.

Analytical parameters do not have multiple analytes, therefore a field analytical method/SOP precision and accuracy table is not necessary here.

No field screening techniques are used.

13.2.2 Fixed Laboratory Quality Controls

Tables 13-3 A-I summarize fixed laboratory QCs.

Analytical parameters do not have multiple analytes, therefore a field analytical method/SOP precision and accuracy table is not necessary here.

Table 13-1
Field QC Samples and Frequency

Matrix	Analytical Parameter	Field QC	Data Quality Indicators	Acceptable Limits*	Corrective Action	Responsible Person	Frequency
Surface Water	Flow Temp/DO	Equipment Blank	Accuracy/Bias Precision	No false readings No negative values No meter error readings.	Recalibrate Change Batteries Resample	Field Sampler	10% of samples
Surface Water/GW	TP TSS Conductivity Turbidity pH Alkalinity Chl-a	Bottle Blank	Contamination (Accuracy/Bias)	No target compounds greater than QL	Clean bottles Retest	Field Sampler	10% of field samples
Surface Water/GW	TP TSS Conductivity Turbidity pH Alkalinity Chl-a Temp/DO Flow Secchi	Field Duplicates -Aliquots	Precision	No target compounds greater than QL	Assess laboratory operations and precision	Field Sampler	10%/parameter/matrix/procedure/sampling team

*Acceptable limits for field duplicates for each parameter is the obtaining of precision for the field duplicate paris which fall within the acceptance limits listed in Sec 7.1.

Table 13-2 A
Field Analytical QC Sample Table

Medium/Matrix	Surface Water
Sampling SOP	B-4
Analytical Parameter	Stream Flow
Analytical Method/ SOP Reference	B-4
Field Analytical Organization	NHDES
No. of Sample Locations	3

Laboratory QC:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)
Other: Field duplicate/replicate	10%	+/- 0.05 m/s	Change Batteries, retest	Field Sampler	Analytical Precision

Table 13-2 B
Field Analytical QC Sample Table

Medium/Matrix	Surface Water
Sampling SOP	B-1
Analytical Parameter	Temperature/Oxygen
Analytical Method/ SOP Reference	B-1
Field Analytical Organization	NHDES
No. of Sample Locations	13

Laboratory QC:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)
Other: Field duplicate/replicate	10%	+/- 10% % Saturation +/- 2 mg/L for DO	Change Batteries check membrane Reanalyze	Biologist	Analytical Precision

Table 13-3 A
Fixed Laboratory Analytical QC Sample Table

Medium/Matrix	Surface Water
Sampling SOP	B-2 and B-3
Analytical Parameter[1]	Total Phosphorus
Analytical Method/ SOP Reference*	Lachat Quick-Chem Method 10-115-01-1-F
Field Analytical Organization	
No. of Sample Locations	18

Laboratory QC:	**Frequency/Number**	**Method/SOP QC Acceptance Limits[2]**	**Corrective Action (CA)**	**Person(s) Responsible for CA**
Method Blank	See reagent blank		See acceptance criteria section of the SOP. Samples re-analyzed until QC is acceptable or data flagged.	Analyst, section supervisor, QC officer
Reagent Blank	1 per run	<MDL		
Laboratory Duplicate	1 out of 8	Range = 0-0.004 or =/-10%		
Laboratory Matrix Spike	10%	82-114%		
LCS	2 read after calibration and at end of run	+/- 20% of 0.005		
LFB	1/run	+/- 10% of 0.050		
Other: ICV	1 per run	+/- 10% of 0.100		

Table 13-3 B
Fixed Laboratory Analytical QC Sample Table

Medium/Matrix	Surface Water
Sampling SOP	B-2 and B-3
Analytical Parameter[1]	Total Suspended Solids
Concentration Level	
Analytical Method/ SOP Reference*	
Field Analytical Organization	
No. of Sample Locations	18

Laboratory QC:	**Frequency/Number**	**Method/SOP QC Acceptance Limits**
Method Blank	1 per run	+/- 5 mg/L
Reagent Blank	NA	
Storage Blank	NA	
Instrument Blank	NA	
Laboratory Duplicate	1 out of 8	0-18 mg/L or =/-10%
Laboratory Matrix Spike	NA	
Matrix Spike Duplicates	NA	
LCS	NA	
LFB	NA	
Surrogates	NA	
Internal Standards (ISs)	NA	
Other: ICV	1 per run	79-104%

Table 13-3 C
Fixed Laboratory Analytical QC Sample Table

Medium/Matrix	Surface Water
Sampling SOP	B-2 and B-3
Analytical Parameter[1]	pH
Analytical Method/ SOP Reference*	C-1
Field Analytical Organization	NHDES Staff/Trained Volunteers
No. of Sample Locations	18

Laboratory QC:	**Frequency/Number**	**Method/SOP* QC Acceptance Limits**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**
Laboratory Duplicate**	10%	+/- .20, .33, .46 or =/-10%	Reanalyze	Analyst	Analytical Precision
Internal Standards (ISs)	N/A				
Other: Initial Calibration	After initial instrument set-up and when calibration verification fails	Per instrument acceptance or +/- .1 pH unit	Recalibrate	Analyst	Accuracy
CVV	10%	+/- .1 pH unit	Recalibrate	Analyst	Accuracy

*Method/SOP QC acceptance limits are equal to measurement performance criteria
**Lab duplicate QC acceptance limit is dependent on meter used: Beckman 220 (0.20), Beckman 360 (0.33), Corning (0.46)

Table 13-3 D
Fixed Laboratory Analytical QC Sample Table

Medium/Matrix	Surface Water
Sampling SOP	B-2
Analytical Parameter[1]	Alkalinity
Analytical Method/ SOP Reference*	C-2
Field Analytical Organization	NHDES Staff/Trained Volunteers
No. of Sample Locations	1

Laboratory QC:	**Frequency/Number**	**Method/SOP* QC Acceptance Limits[2]**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**
Instrument Blank					
Laboratory Duplicate**	10%	+/-1.11, 1.02, 1.05 or =/-10%	Reanalyze	Analyst	Analytical Precision

*Method/SOP QC acceptance limits are equal to measurement performance criteria
**Lab duplicate QC acceptance limit is dependent on meter used: Beckman 220 (0.20), Beckman 360 (0.33), Corning (0.46)
***Since initial pH reading is documented in pH section of pH/ANC bench book when measuring ANC, the initial pH reading will be subject to the QC requirements of Table 13-3D.

Table 13-3 E
Fixed Laboratory Analytical QC Sample Table

Medium/Matrix	Surface Water
Sampling SOP	B-2 and B-3
Analytical Parameter[1]	Conductivity
Analytical Method/ SOP Reference*	C-3
Field Analytical Organization	NHDES/Trained Volunteers
No. of Sample Locations	12

Laboratory QC:	**Frequency/Number**	**Method/SOP* QC Acceptance Limits**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**
Laboratory Duplicate**	10%	0-200 range +/-.59 >200-1500 range +/- 11.87 or =/-10%	Reanalyze	Analyst	Analytical Precision
Other: Initial Calibration	After initial setup and when CCV Fails	Per instrument criteria	Recalibrate	Analyst	Accuracy
CCV	10%	+/- 10%	Reanalyze	Analyst	Accuracy

*Method/SOP QC acceptance limits are equal to measurement performance criteria

Table 13-3 F

Fixed Laboratory Analytical QC Sample Table

Medium/Matrix	Surface Water
Sampling SOP	B-2 and B-3
Analytical Parameter[1]	Turbidity
Analytical Method/ SOP Reference*	C-4
Field Analytical Organization	NHDES/Trained Volunteers
No. of Sample Locations	12

Laboratory QC:	**Frequency/Number**	**Method/SOP* QC Acceptance Limits**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**
Laboratory Duplicate	10%	0-1.99= 0.16 2-19.9= 2.60 20-200= 5.00 or =/-10%	Reanalyze	Analyst	Analytical Precision
Internal Standards (ISs)					
Other: Initial Calibration	After initial instrument setup and when CCV fails	+/- 0.05 NTU	Recalibrate	Analyst	Accuracy
CCV	10%	+/- 10%	Recalibrate	Analyst	Accuracy

*Method/SOP QC acceptance limits are equal to measurement performance criteria

Table 13-3 G
Fixed Laboratory Analytical QC Sample Table

Medium/Matrix	Surface Water
Sampling SOP	B-2
Analytical Parameter[1]	Chlorophyll-a
Analytical Method/ SOP Reference*	C-5
Field Analytical Organization	NHDES/Trained Volunteers
No. of Sample Locations	1

Laboratory QC:	**Freq./Number**	**Method/SOP* QC Acceptance Limits**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**
Instrument Blank	One per analytical shift	N/A	Instrument Correction	Instrument	Accuracy/Bias (contamination_
Laboratory Duplicate	10%	0-5= 1.01 >5-10= 1.70 >10-30= 2.84 or =/-10%	Review Bench book sample information	Analyst	Analytical Precision

*Method/SOP QC acceptance limits are equal to measurement performance criteria

Table 13-3 H
Fixed Laboratory Analytical QC Sample Table

Medium/Matrix	Surface Water
Sampling SOP	B-2
Analytical Parameter[1]	Plankton
Analytical Method/ SOP Reference*	C-12
Field Analytical Organization	NHDES
No. of Sample Locations	1

Laboratory QC:	**Freq./Number**	**Method/SOP QC Acceptance Limits[2]**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**
Internal Standards (ISs)	N/A				
Other: Field duplicate/replicate	10%	N/A	N/A	Field Sampler	Analytical Precision

14.0 Data Acquisition Requirements (Non-direct Measurements)

Table 14-1 summarizes Non-direct Measurements Criteria and Limitations

Table 14-1
Non-Direct Measurements Criteria and Limitations

Non-Direct Measurement	Data Source/Generator	How Data Will Be Used	Limitations on Data Use
VLAP Data	NHDES VLAP Program	Historical Data	Only summer data available
Lake Assessment Data	NHDES Lake Assessment Program	Historical Data	No tributary data
Fish and Game Lake Data	NH Fish and Game Department	Historical Data	No tributary data
Topographic Maps	USGS	Site maps, watershed boundary, topography	Date of data collection and map generation
Weather Data	Lakeport Dam, Lakeport, NH	Precipitation and Evaporation Data	None

None of the data in the table above were generated under an approved QAPP, however, methods for VLAP and Lake Assessment data are the same as those detailed in this QAPP. Data to be used for historical reference is not as detailed or as frequently collected as the data that will be collected in the Rust Pond Lake and Watershed Diagnostic Study. Data collected from these studies were not validated or generated from models or algorithms.

[Data from the VLAP program are derived from VLAP databases which are cross-referenced with field notes and bench books for accuracy. Lake assessment data are from hardcopies.] Data from Fish and Game are from a report booklet published in the late 1930s.

15.0 Documentation, Records, and Data Management

15.1 Project Documentation and Records

Table 15-1
Project Documentation and Records Table

Sample Collection Records	Field Analysis Records	Fixed Laboratory Records	Project Data Assessment Records
Field data sheets	Raw field data	Bench book records	QA/QC Report
		Computer databases	
		Billing receipts for sample analyses	

15.2 Field Analysis Data Package Deliverables

Field Analytical-Definitive Data-Field Measurement
Field analytical data will be used as screening data rather than as definitive data in this project. Field analytical data will be generated instantaneously, at the same time samples will be collected for laboratory analysis. Measurements will be recorded on a field datasheet, and these data will be transferred to an electronic spreadsheet. Entries into the spreadsheet will be compared against the field sheet by a second person as a quality check.

When volunteers sample the lake and watershed, completed data forms and samples must be returned to the laboratory within 24 hours. All information collected in the field by volunteers will be kept by NHDES.

All raw data will be kept by NHDES.

15.3 Fixed Laboratory Data Package Deliverables

Data from parameters analyzed in the NHDES Limnology Center will be entered immediately upon analysis into meter-respective bench books. These data will then be entered weekly into a project database and cross-referenced with bench book data upon printout.

Data analyzed in the NHDES Laboratory Services Unit will be electronically entered into the Limnology Center database upon completion of the analyses. Turnaround times for all samples are 30 days. Laboratory login sheets and custody sheets are returned as well.

15.4 Data Reporting Formats

Field recordings will be made in ink. No data are being collected in this project for legal proceedings, therefore there are no set procedures for recording data, other than the field data sheets shown in Appendix D. Field and laboratory data will be recorded in electronic

spreadsheets that will be designed for this study. There are no standard procedures for format or content; their content will be appropriate for the project.

15.5 Data Handling and Management

Data Recording

As data are analyzed results are entered into equipment appropriate bench books in black or blue ink. Replicate and critical range analyses are performed for 10% of these data. These data are then entered into a MS Access database where they are queried for reports. Queried reports are cross-referenced with bench book data to ensure accuracy. Personnel who enter and check data add their initials to the bench book for accountability purposes. These data entries and checks occur weekly. Examples of data sheets are included in Appendix D.

Data received from NHDES Laboratory Services are electronically sent to the Limnology Center Database. These data are already checked and verified by the Laboratory Services Unit for completeness.

Data Transformations/Data Reduction

Data are analyzed statistically in spreadsheet programs (Sigma Plot and Excel) for ranges, means, medians, standard deviations, and minimum and maximum values. Data transformations are conducted at the end of the study when the data sequence is selected from the 16-month study. Data are checked through manual calculations on a 10% check ratio. Hydrologic budget, nutrient budget, and modeling calculations can be found in Appendix F.

Data Transfer/Transmittal

Data are frequently copied and pasted between various programs depending on the need for various statistical analyses and graphic capabilities of software. Transferred data are cross-referenced with original data.

Data Analysis

Software

Microsoft Excel
Jandel Sigma Plot/Sigma Stat
Lotus 1,2,3
FoxPro

Analytical Models

NHDES Trophic Classification
Carlson Trophic Index
Vollenweider Model
Dillon/Rigler Model

Data Assessment

Data will be manually cross-referenced with bench book entries to verify accuracy in computer entry.

Statistical analyses will be verified through manual calculations.

Statistical computer programs to be used to analyze data were listed above in Data Analysis Section.

15.6 Data Tracking and Control

Data Tracking

Data tracking is summarized in Data Management SOP in Appendix C.

Data Storage, Archival, and Retrieval

All data are stored in the following ways:

Hardcopies
Maps
Photographs
Septic System Surveys
Model Calculations
Raw Data
Final Report

Electronic Copies
Raw Data
Statistical Results
Final Report

All data will be stored indefinitely by NHDES on a permanent network system that is backed-up nightly. Data will also be stored on diskettes. Archived information will be packaged by project manager (Amy Smagula).

Data Security
All data are public information and need not be secured.

16.0 Assessments and Response Actions

16.1 Planned Assessments

See Table 16-1 for planned assessments in the Rust Pond Diagnostic Study.

16.2 Assessment Findings and Corrective Actions

Field Sampling Technical Systems Audit (TSA)-QAPP deviations and project deficiencies determined during the field sampling TSA will be evaluated for source of deviation and corrected with verbal communications in the field. Any necessary written/structural changes will be made through a revision of the SOP for that activity. Field sampling activities will be monitored to determine compliance.

Field Analytical TSA-QAPP deviations and project deficiencies determined during the field analytical TSA will be evaluated for source of deviation and corrected with verbal communications in the field. Any necessary written/structural changes will be made through a revision of the SOP for that activity. Field analytical activities will be monitored to determine compliance.

Limnology Center Fixed Laboratory TSA-QAPP deviations and project deficiencies determined during the limnology center fixed laboratory TSA will be addressed immediately. Replicates and critical range tables will be checked with data to determine if sources of error exist. Data will be entered into the computer weekly and cross-referenced with bench books for accuracy. Any deviations in results will be addressed in both written and verbal formats, and future sampling will be monitored to verify that compliance is reached.

NHDES Laboratory Services Fixed Laboratory TSA-QAPP deviations and project deficiencies determined during the NHDES Laboratory Services fixed laboratory TSA will be addressed immediately. Replicates and critical range tables will be checked with data to determine if sources of error exist. Data will be entered into the computer weekly and cross-referenced with bench books for accuracy. Any deviations in results will be addressed in both written and verbal formats, and future sampling will be monitored to verify that compliance is reached. Checklists for use in assessing samping activities and field and/or lab analytical activities will be used to evaluate both in-house and volunteer activities. Copies of these will be included with the final report.

16.3 Additional QAPP Non-Conformances

Corrective actions will be implemented any time that deviations or errors are noted in field and laboratory work during the project.

Table 16-1
Project Assessment Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) responsible for performing assessment, title and organizational affiliation	Person(s) responsible for responding to assessment findings, title and organizational affiliation	Person (s) responsible for identifying and implementing corrective actions (CA), title and organizational affiliation	Person (s) responsible for monitoring effectiveness of CA, title and organizational affiliation
Field Sampling TSA	Once at beginning of study	Internal	NHDES	Amy P. Smagula Clean Lakes Coordinator NHDES	Amy P. Smagula Clean Lakes Coordinator NHDES	Amy P. Smagula Clean Lakes Coordinator NHDES	Amy P. Smagula Clean Lakes Coordinator NHDES
Field Analytical TSA	Once at beginning of study	Internal	NHDES	Amy P. Smagula Clean Lakes Coordinator NHDES	Amy P. Smagula Clean Lakes Coordinator NHDES	Amy P. Smagula Clean Lakes Coordinator NHDES	Amy P. Smagula Clean Lakes Coordinator NHDES
Limnology Center Fixed Lab TSA	Bi-Weekly	Internal	NHDES	Steve Couture QA/QC Officer NHDES	Steve Couture QA/QC Officer NHDES	Steve Couture QA/QC Officer NHDES	Steve Couture QA/QC Officer NHDES
NHDES Laboratory Services Fixed Lab TSA	Weekly	Internal	NHDES	Rachel Rainey Chem Lab QA/QC Officer NHDES	Rachel Rainey Chem Lab QA/QC Officer NHDES	Rachel Rainey Chem Lab QA/QC Officer NHDES	Rachel Rainey Chem Lab QA/QC Officer NHDES

17.0 QA Management Reports

No QA Management Reports will be generated for the project. In lieu of frequent QA Management Reports, a QA/QC section will be included in the final project report, and will include the following items:

- Summary of project QA/QC programs and trainings conducted during the project
- Conformance of project activities to QAPP requirements/procedures
- Status of project and schedule delays
- Deviations from the approved QAPP and approved amendments to the QAPP
- Results and trends of PESs by laboratory (per parameter, matrix and concentration level)
- Description and findings of TSAs and other assessments
- Results of data validation activities in terms of amount of usable data generated
- Required corrective actions and effectiveness of corrective action implementation
- Data quality assessments in terms of precision, accuracy, representativeness, completeness, comparability, and sensitivity (Refer to Section 20.0)
- Limitations on the use of measurement data generation

Though frequent QA management reports will not be generated, frequent reviews of data (as described in Section 16) will be conducted to determine sampling efficiency.

The Final Project Report will meet project quality objectives and will include:

- Development of project quality objectives, narrative and timeline of project activities
- Summary of major/critical problems encountered, and their resolution
- Data summary including tables, charts, and graphs with appropriate sample identification/station location numbers, concentration units, and data quality flags (percent solids is not applicable in this study)
- Reconciliation of project data with project quality objectives
- Conclusions and recommendations

18.0 Verification and Validation Requirements

The Region I, EPA-New England Data Validation Functional Guidelines for Evaluating Environmental Analyses will not be used for this project.

Data validation will occur through the detailed examination of raw data to check for calculation, compound identification, and transcription errors. Data of known and documented quality will be provided from this examination.

In addition, the results of QC checks and samples, analytical procedures and PE sample results will be assessed and applied to statistical tests.

These data examinations are essentially those used in Tier II and Tier III, however the exact protocols of The Region I, EPA-New England Data Validation Functional Guidelines for Evaluating Environmental Analyses will not be used.

19.0 Verification and Validation Procedures

19.1 Verification

Table 19-1 describes the process that will be followed to verify and validate data.

Table 19-1
Data Verification Process

Verification Task	Description	I/E	Responsible for Verification
Field Data/Field Notes	Field data sheets will be collected at the end of each sampling event and analyzed for completeness and accuracy.	I	Amy P. Smagula NHDES
NHDES Limnology Center Data	These data will be subject to a 10% replicate and critical range analysis in the lab. The QA/QC officer will check the accuracy of these samples. Lab personnel will conduct data entry and comparison to bench book data.	I	Steve Couture NHDES Laboratory Personnel NHDES
NHDES Laboratory Services Unit Data	Data generated in this laboratory will be checked by the laboratory QC personnel and then transferred to the Limnology Database where it will also be checked by the project manager.	I/E	Rachel Rainey NHDES Laboratory Services Amy P. Smagula NHDES
Final Report Data Analyses and Recommendations	The final project report will be analyzed for content, accuracy, and for types of recommendations made for problems found during the data acquisition phase of the study.	I	Jody Connor NHDES

19.2 Validation

Table 19-2 summarizes which sampling, handling, field analytical and fixed laboratory data will be validated.

Table 19-2
Data Validation Summary Table

Medium/ Matrix	Analytical Parameter	Validation Criteria	Validation Criteria Modified	Data Validation Tier Level	Modified Tier Level Used	Data Validation (Name, title and organizational affiliation)	Responsibility for Data Validations (Name, title and organizational affiliation)
Surface Water/GW	Total Phosphorus					Rachel Rainey NHDES Laboratory Services 603-271-2993	Amy P. Smagula NHDES 603-271-2248
Surface Water	TSS					Rachel Rainey NHDES Laboratory Services 603-271-2993	Rachel Rainey NHDES Laboratory Services 603-271-2993
Surface Water/GW	pH	See description of validation criteria discussed in Section 18.0	Y	See description in Section 18.0	Y	Amy P. Smagula NHDES 603-271-2248	Steve Couture NHDES QA/QC Officer 603-271-8801
Surface Water	ANC	See description of validation criteria discussed in Section 18.0	Y	See description in Section 18.0	Y	Amy P. Smagula NHDES 603-271-2248	Steve Couture NHDES QA/QC Officer 603-271-8801
Surface Water/GW	Turbidity	See description of validation criteria discussed in Section 18.0	Y	See description in Section 18.0	Y	Amy P. Smagula NHDES 603-271-2248	Steve Couture NHDES QA/QC Officer 603-271-8801
Surface Water/GW	Conductivity	See description of validation criteria discussed in Section 18.0	Y	See description in Section 18.0	Y	Amy P. Smagula NHDES 603-271-2248	Steve Couture NHDES QA/QC Officer 603-271-8801

Medium/ Matrix	Analytical Parameter	Validation Criteria	Validation Criteria Modified	Data Validation Tier Level	Modified Tier Level Used	Data Validation (Name, title and organizational affiliation)	Responsibility for Data Validations (Name, title and organizational affiliation)
Surface Water/GW	Plankton	See description of validation criteria discussed in Section 18.0	Y	See description in Section 18.0	Y	Amy P. Smagula NHDES 603-271-2248	Steve Couture NHDES QA/QC Officer 603-271-8801
GW	Seepage Data	See description of validation criteria discussed in Section 18.0	Y	See description in Section 18.0	Y	Amy P. Smagula NHDES 603-271-2248	Steve Couture NHDES QA/QC Officer 603-271-8801
GW	IPWS	See description of validation criteria discussed in Section 18.0	Y	See description in Section 18.0	Y	Amy P. Smagula NHDES 603-271-2248	Amy P. Smagula NHDES 603-271-2248
Surface Water	Flow	See description of validation criteria discussed in Section 18.0	Y	See description in Section 18.0	Y	Amy P. Smagula NHDES 603-271-2248	Amy P. Smagula NHDES 603-271-2248

Table 19-3 summarizes Data Validation Modifications.

Table 19-3
Data Validation Modifications

Modifications
• Mixing of Tiers II and III were done to modify the validation methods to be comparable to those used by NHDES. • Tier I components are not done by NHDES Limnology Center.

20.0 Data Usability/Reconciliation with Project Quality Objectives

Note: Critical environmental decisions will not be made as a result of this study. This project does not follow the formal DQO process, so section 20 is not entirely applicable. The following items address some aspects of data review.

Preliminary Data Review
Data will be reviewed for completeness throughout and at the end of the field study. An evaluation of data completeness will be conducted at that time.

Precision
Results of all field and laboratory duplicates will be presented separately in tabular format for each analysis. For each duplicate pair, the relative percent difference (RPDs) will be calculated for each analyte whose original and duplicate values are greater than or equal to the quantitation limit. RPDs will be compared against the measurement performance criteria presented in Table 7-1. Those RPDs will be highlighted in the tables.

Accuracy/Bias
Sample Contamination-
Sample contamination will be addressed through the analysis of field and lab blanks. The comparison of samples with their duplicates provides measures of precision. The analysis of field duplicates provides a measure of total precision, and will be used to determine accuracy of sampling and analysis.

Analytical Accuracy/Bias-
Analytical duplicates will be conducted to determine deviations within laboratory analyses. Differences between sample and duplicate (replicate pairs) will be determined through the use of the Accuracy/Bias equation used in Section 7.2 of the QAPP.

Overall Accuracy/Bias
Data will be compared with critical ranges to determine accuracy/bias of the samples, and through the use of the Accuracy/Bias equation used in Section 7.2 of the QAPP.

Sample Representativeness
Field sampling SOPs will be strictly adhered to. If variation in sample results occurs, stream bracketing or repeat sampling may take place to ensure sample representativeness.

NE – QAPP Worksheet

QA/QC Activities

Completeness
Data will be reviewed for completeness by determining the total number of anticipated samples that were determined at the outset of the study, and comparing that number with the actual number of data collected. [(Actual # / Total #) * 100]. See section 7.2.

Comparability
Data will be manually compared to measurement performance criteria. If samples are not acceptable they will not be included in the final calculations. See Section 7.2.

Data Limitations and Actions
When data do not meet acceptable standards they will be flagged and omitted from final calculations. If the data set is limited, and questionable data must be used, they will be used for reference only, and will be footnoted that data are questionable.

1. Identify Guidance used to prepare QAPP: Region 1 EPA-NE Compendium Quality Assurance Project Guidance, Final October 1999

2. Identify EPA Program: Clean Water Act Section 319, Nonpoint Source Program

3. Identify approval entity: EPA-NE or State: EPA-NE
or other entity:

4. Indicate whether the QAPP is a generic program QAPP or a **Project specific QAPP**. (underline one)

5. List dates of scoping meetings that were held: January 19, 2001; 8/24/99

6. List title of QAPP documents and approval dates written for previous site work, if applicable: N/A

Title: N/A Approval Date: N/A

7. List organizational partners (stakeholders) and connection with EPA and/or State:

NH Department of Environmental Services, Water Division, Biology Section
Rust Pond Lake Association- Volunteer Monitors in state Volunteer Lake Assessment Program

8. List data users:

NH Department of Environmental Services, Rust Pond Lake Association, Town of Wolfeboro, EPA New England, Team New Hampshire

9. If any required QAPP Elements (1-20), Worksheets and/or Required Information are not applicable the project, then circle the omitted QAPP Elements, Worksheets and Required Information on the attached Table. Provide an explanation for their exclusion below:

1. *Agendas and project planning meeting documentation are not included because they were not used.*
2. *EPA-NE DQO Summary form is not included.*
3. *QA Management Reports (Worksheet #28) will not be included because these reports will not be prepared during the course of this study.*

Required EPA QA/R-5 QAPP Elements	Required EPA-NE QAPP Elements and Corresponding EPA-NE QAPP Sections	EPA-NE QAPP Worksheet #	Required Information
Project Management and Objectives			
A1	1.0 Title and Approval Page	1	-Title and Approval Page
A2	2.0 Table of Contents and Document Format 2.1 Table of Contents 2.2 Document Control Format 2.3 Document Control Numbering System 2.4 EPA-NE QAPP Worksheet #2	2	-Table of Contents -EPA-NE QAPP Worksheet
A3	3.0 Distribution List and Project Personnel Sign-off Sheet	3 4	-Distribution List -Project Personnel Sign-off Sheet
A4, A8	4.0 Project Organization 4.1 Project Organizational Chart 4.2 Communication Pathways 4.2.1 Modifications to Approved QAPP 4.3 Personnel Responsibilities and Qualifications 4.4 Special Training Requirements/ Certification	5a 5b 6 7	-Organizational Chart -Communication Pathways -Personnel Responsibilities and Qualifications Table -Special Personnel Training Requirements Table
A5	5.0 Project Planning/Project Definition 5.1 Project Planning Meetings 5.2 Problem Definition/Site History and Background	8a 8b	-Project Scoping Meeting Attendance **Sheet with Agenda and other Project Planning Meeting Documentation** -Problem Definition/Site History and Background -**EPA-NE DQO Summary Form** -Site Maps (historical and present)
A6	6.0 Project Description and Schedule 6.1 Project Overview 6.2 Project Schedule	9a 9b 9c 9d 10	-Project Description -Contaminants of Concern and Other Target Analytes Table -Field and Quality Control Sample Summary Table -Analytical Services Table -System Designs -Project Schedule Timeline Table
A7	7.0 Project Quality Objectives and Measurement Performance Criteria 7.1 Project Quality Objectives 7.2 Measurement Performance Criteria	11a 11b	-Project Quality Objectives/Decision Statements -Measurement Performance Criteria Table

Measurement/Data Acquisition			
B1	8.0 Sampling Process Design 8.1 Sampling Design Rationale	12a 12b	-Sampling Design and Rationale -Sampling Locations, Sampling and Analysis Method/SOP Requirements Table -Sample Location Map
B2, B6, B7, B8	9.0 Sampling Procedures and Requirements 9.1 Sampling Procedures 9.2 Sampling SOP Modifications 9.3 Cleaning and Decontamination of Equipment/Sample Containers 9.4 Field Equipment Calibration 9.5 Field Equipment Maintenance, Testing and Inspection Requirements 9.6 Inspection and Acceptance Requirements for Supplies/Sample Containers	13 12b 14 15	-Sampling SOPs -Project Sampling SOP Reference Table -Sampling Container, Volumes and Preservation Table -Field Sampling Equipment Calibration Table -Cleaning and Decontamination SOPs -Field Equipment Maintenance, Testing and Inspection Table
B3	10.0 Sample Handling, Tracking and Custody Requirements 10.1 Sample Collection Documentation 10.1.1 Field Notes 10.1.2 Field Documentation Management System 10.2 Sample Handling and Tracking System 10.3 Sample Custody	16	-Sample Handling, Tracking and Custody SOPs -Sample Handling Flow Diagram -Sample Container Label (Sample Tag) -Chain-of-Custody Form and Seal
B4, B6, B7, B8	11.0 Field Analytical Method Requirements 11.1 Field Analytical Methods and SOPs 11.2 Field Analytical Method/SOP Modifications 11.3 Field Analytical Instrument Calibration 11.4 Field Analytical Instrument/ Equipment Maintenance, Testing and Inspection Requirements 11.5 Field Analytical Inspection and Acceptance Requirements for Supplies	17 18 19	-Field Analytical Methods/SOPs -Field Analytical Method/SOP Reference Table -Field Analytical Instrument Calibration Table -Field Analytical Instrument/Equipment Maintenance, Testing and Inspection Table

B4, B6, B7, B8	12.0 Fixed Laboratory Analytical Method Requirements 12.1 Fixed Laboratory Analytical Methods and SOPs 12.2 Fixed Laboratory Analytical Method/SOP Modifications 12.3 Fixed Laboratory Instrument Calibration 12.4 Fixed Laboratory Instrument/ Equipment Maintenance, Testing and Inspection Requirements 12.5 Fixed Laboratory Inspection and Acceptance Requirements for Supplies	20 21	-Fixed Laboratory Analytical Methods/SOPs -Fixed Laboratory Analytical Method/SOP Reference Table -Fixed Laboratory Instrument Maintenance and Calibration Table
B5	13.0 Quality Control Requirements 13.1 Sampling Quality Control 13.2 Analytical Quality Control 13.2.1 Field Analytical QC 13.2.2 Fixed Laboratory QC	22a 22b 23a 23b 24a 24b	**Sampling** -Field Sampling QC Table -Field Sampling QC Table cont. **Analytical** -Field Analytical QC Table -Field Analytical QC Table cont. -Field Screening/Confirmatory Analysis Decision Tree -Fixed Laboratory Analytical QC Sample Table -Fixed Laboratory Analytical QC Sample Table cont.
B9	14.0 Data Acquisition Requirements	25	-Non-Direct Measurements Criteria and Limitations Table
A9, B10	15.0 Documentation, Records and Data Management 15.1 Project Documentation and Records 15.2 Field Analysis Data Package Deliverables 15.3 Fixed Laboratory Data Package Deliverables 15.4 Data Reporting Formats 15.5 Data Handling and Management 15.6 Data Tracking and Control	26	-Project Documentation and Records Table -Data Management SOPs
Assessment/Oversight			
C1	16.0 Assessments and Response Actions 16.1 Planned Assessments 16.2 Assessment Findings and Corrective Action Responses 16.3 Additional QAPP Non-Conformances	27a 27b 27c	-Assessment and Response Actions -Project Assessment Table -Project Assessment Plan -Audit Checklists
C2	17.0 QA Management Reports	28	**-QA Management Reports Table**

Data Validation and Usability			
D1	18.0 Verification and Validation Requirements		-Validation Criteria Documents
D2	19.0 Verification and Validation Procedures	29a 29b 29c	-Data Evaluation Process -Data Validation Summary Table -Data Validation Modifications
D3	20.0 Data Usability/Reconciliation with Project Quality Objectives	30	-Data Usability Assessment